CERL Maps Buried Sewer Pipes at Illinois Ammo Plant

By Stephen Cosper and Michelle Hanson

A team of researchers from the Engineer Research and Development Center (ERDC) completed a study at Joliet Army Ammunition Plant, Ill. (JOAAP) to locate, map, and assess explosive status of the underground sewer system. Inactive since 1976, the plant, which is a Superfund site, will ultimately be transferred in large part to the U.S. Forest Service to become a nature area.

JOAAP dates to 1941 when it was quickly built to support the WWII effort. It originally had two separate facilities: the Kankakee Ordnance Works (KOW) and the Elwood Ordinance Plant. KOW produced trinitrotoluene (TNT) and other energetic materials (EM), once setting the national record for TNT production. Elwood was a Load-Assemble-Pack (LAP) plant that processed artillery shells, bombs, mines, and small arms ammunition. Activities also included ammunition testing, washout, and shell renovation.

The Army has begun decontaminating aboveground structures from the LAP area, most of which is slated for transfer to the Forest Service. However, the underground structures posed a challenge. The sanitary sewer, storm water, and subsurface industrial piping all potentially contained residual EM, which would create an explosive hazard in the event of future excavation. Existing maps and other drawings of the system were incomplete and inaccurate. Before the land could be transferred, the Army had to provide an accurate map of all buried structures and assurance that the sewer system does not pose an explosive hazard.

The Base Realignment and Closure (BRAC) Office asked ERDC's Construction Engineering Research Laboratory (CERL) to locate and document all of the buried components, then to test the identified sections for presence of EM. If the team found levels of EM exceeding safe limits specified by the Environmental Protection Agency, the Army has the option to dig and remove the entire sewer system or to remediate in place.

Smoking Out and Mapping the System

Sewer structures to be recorded and mapped included manholes, sewer mains, laterals, catch basins, surface inlets, and septic connections. Buildings, roads, fence lines, and other features were also to be mapped to provide context to the sewer layout. First, the installation "archives" were searched for historical information. A few

maps were found that showed approximate locations of the sanitary sewer, storm sewer, and associated manholes. However, the incomplete information, combined with overgrowth of vegetation, made it impossible to characterize the system using those maps.

Testing for explosive materials in samples collected from the sewer system.

To find sewer structures and verify the sources of laterals and mains, CERL used smoke testing, a method commonly used in the sewer maintenance industry to locate pipes and to test the integrity of known (and unknown) pipelines. This test is conducted by placing a blower over a manhole and forcing smoke-filled air through the sewer line. Under the pressure of the blower, the smoke fills the sewer line and any connections, then follows any path of low resistance to openings to the surface. These openings may be storm inlets, catch basins, holes in manhole covers, and even leaks in the sewers and buried inlets that are not too deep.

This technique was especially valuable in finding connections to sewer mains where there were no manholes. Specific portions of the sewer system were isolated by plugging selected sewer pipes, allowing maximum pressure to build up in sections of sewer mains where buried lateral connections were suspected.

Finally, an electronic system involving radio frequency transmission and detection was used. This system allowed CERL personnel to map underground piping at locations where smoke detection was not effective.

As researchers collected data and coordinates from the smoke and radio detection testing, they entered this information into a hand-held device called the *ike*™. Developed by ERDC for installation field applications and built by Surveylab of New Zealand, the tool has a data collection feature that integrates mobile geographic information system (GIS) with a global positioning system (GPS), digital camera, laser distance meter, compass, and inclinometer. The *ike*™ allows a user to aim at a target, photograph it, and at the same time calculate and log the coordinates of the target location. It is an efficient way to map structures and geographical features, and to record reference data associated with specific GPS locations. *[Editor's note: Please see the CERL homepage for a related feature about HAMMER™, the current generation of the ike™, which has been commercialized.]*

Once the manholes and other surface structures were located, GPS coordinates were obtained from the *ike*™. These coordinates were later used to develop a complete, detailed digital map of the sanitary and storm sewers.

Testing for Explosive Residue

Using the newly created map, CERL next took samples at strategic locations within the system to test for EM. Jar samples were collected for analysis at an accredited laboratory using USEPA Method 8330, "Nitroaromatics and Nitramines by High-Performance Liquid Chromatography." This method determines the concentration of several different energetic compounds in a water, soil, or sediment sample. The team also used two commercial products in the field, Exspray and Drop-Ex, to test for the presence of EM.

Findings showed very little EM contamination in the sanitary sewer system.. The levels detected at most locations were well below the EPA limits. The locations discovered to contain higher EM concentrations were almost all nearby heavily contaminated production buildings, as expected. CERL has provided a complete report with findings and recommendations to the BRAC Office and JOAAP site manager.

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